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V. *Memoranda made during the appearance of the "Aurora Borealis" on the 18th of November, 1835. By CHARLES C. CHRISTIE, Esq. M.A. Communicated by S. HUNTER CHRISTIE, Esq. M.A. F.R.S. &c.*

Received and Read December 10, 1835.

AS the following Memoranda, noted down during the remarkable Aurora of the 18th of November, have been considered of sufficient interest to be read before the Royal Society, I think it right to state, that I did not anticipate that this would be the case, and that my only object in making them was, to record carefully whatever remarkable appearance might present itself, for the information of one who, I knew, felt a deep interest in every phenomenon of the kind, and whose simultaneous observations I hoped to have the pleasure of comparing with my own. Being, however, unwilling to make any alteration in a statement of facts, I have preferred leaving them exactly as they were communicated, merely offering a few additional explanations and remarks, suggested by striking exhibitions of the phenomenon.

Memoranda.

Wednesday evening, 9 o'clock.—Remarked, on looking accidentally from the drawing-room window of Deal Castle, a bright light over Ramsgate, exactly as if the moon were about to rise in that quarter. Saw, on proceeding to the roof, a perfect and very bright arch to the north; the lower edge being sharply defined on the dark cloud beneath, the upper shaded off into the sky. The sky, except beneath the luminous arch, perfectly cloudless; the stars shining brightly down to its upper edge. The wind rather high and gusty, not particularly cold, and north-north-west (by the ventometer). Altitude of the arch about that of γ Ursæ Majoris. Western extremity terminating exactly below α Aquilæ.

9^h 5^m.—The arch itself motionless, but large bodies of faint vapoury light continually ascending from it, and whirled in every direction, across the zenith, &c., as if by the wind, and with such rapidity as scarcely to be followed by the eye. These frequently rose perpendicularly, and were then sharply whisked off towards the south-east. (See Sketch 1. Plate II.)

9^h 15^m.—A fine outbreak of pencils of light from the centre and eastern extremity of the arch; none of them stationary, or in straight lines, but waving more or less and flickering, as if with the wind; masses of vapoury light whirled up occasionally; the whole presenting the appearance of an immense and not distant, conflagration,

while the paleness of the light and the absence of noise gave it a spectral and unearthly character, which was very striking. The gusts of wind increased the illusion. (See Sketch 2. Plate II.)

9^h 20^m.—The arch becoming very irregular; a large indentation on the eastern side, thus :

Fig. A.



The pseudo-flames have almost entirely subsided; they still exhibit the same appearance of burning, but in a steadier manner.

The centre of the arch is about equidistant from γ Ursæ Majoris and α Lyræ.

9^h 25^m.—The western extremity suddenly blazed up; one very broad pencil of rose-coloured light forming the western boundary to the rest; through it α Aquilæ shone with great brilliancy. All these westerly pencils perfectly straight, of greater altitude, and of a more defined and steady light than the easterly. Extremely narrow brilliant jets of light issuing from the central part, and having their base in the midst of the dark cloud. (See Sketch 3. Plate III.)

9^h 27^m.—Arch dilapidated. (See Sketch 4. Plate III.)

9^h 30^m.—Arch entirely broken up.

9^h 35^m.—The arch restored, but of an irregular undulating form, thus :

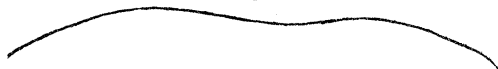
Fig. B.



The light fainter, as also the pencils which continue to rise from every part, but more distinctly from the two extremities.

9^h 55^m.—The arch much depressed, and in form thus :

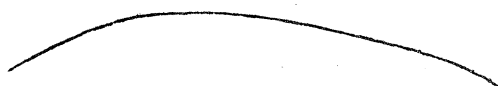
Fig. C.



The cloud below much darker, the pencillings very faint.

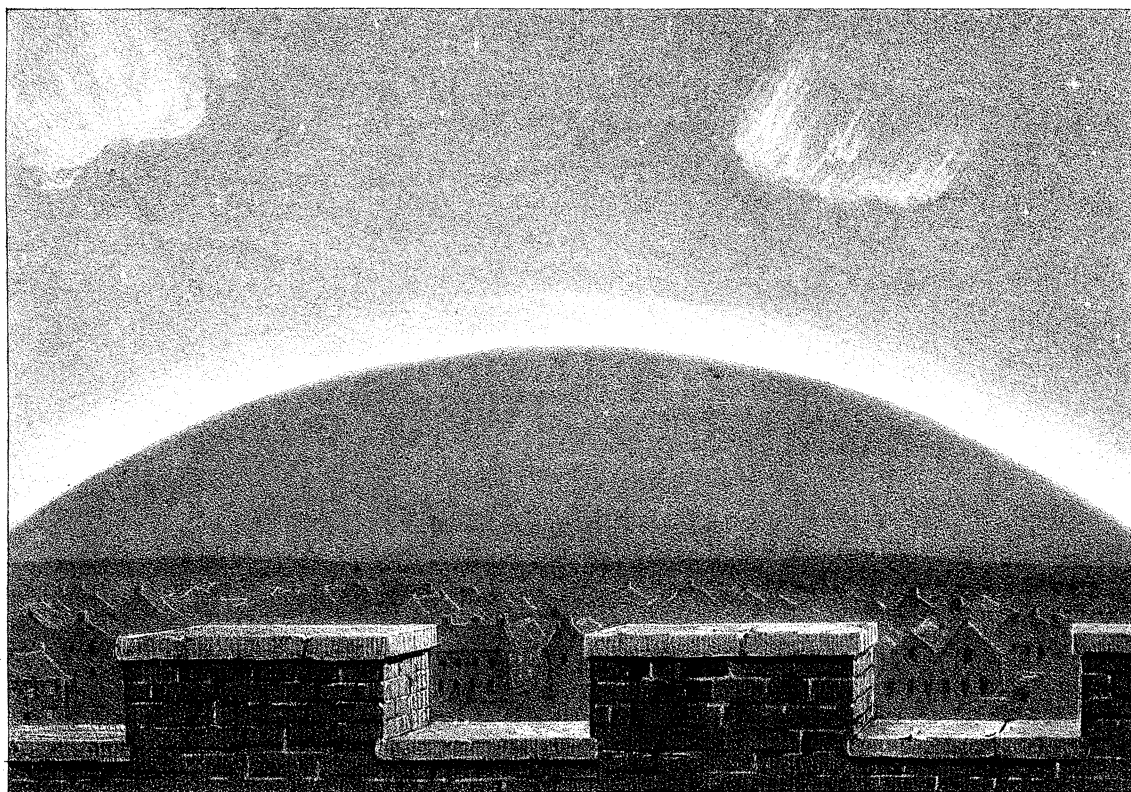
10^h 20^m. The arch strongly defined and steady; but occasional gleams, as of the vapoury light rising in a body simultaneously from the whole extent of it. The cloud very dark, and of this form :

Fig. D.

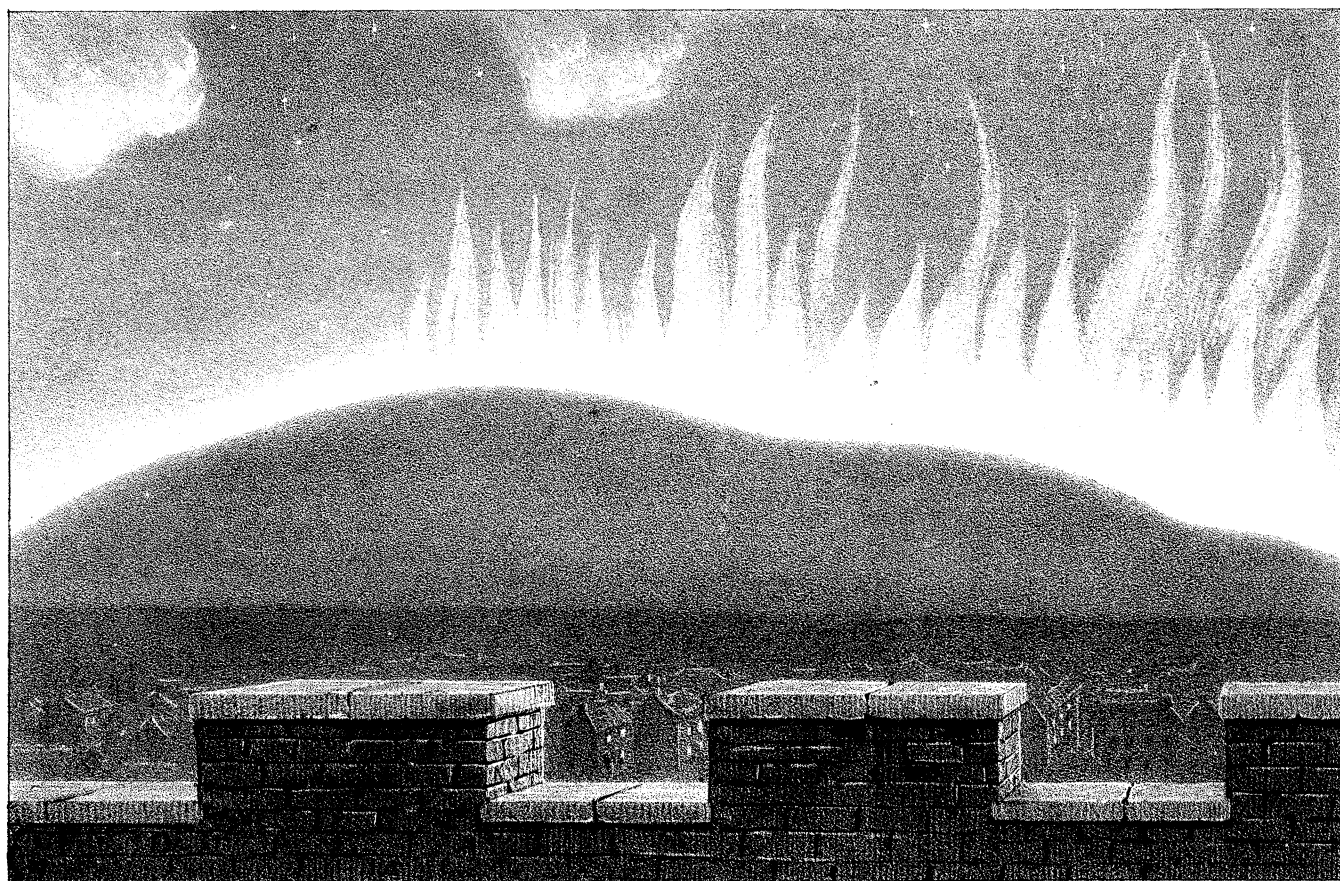


I regret that I was unable to wait for the total disappearance of the phenomenon, though for nearly an hour there had been no promise of any fresh display.

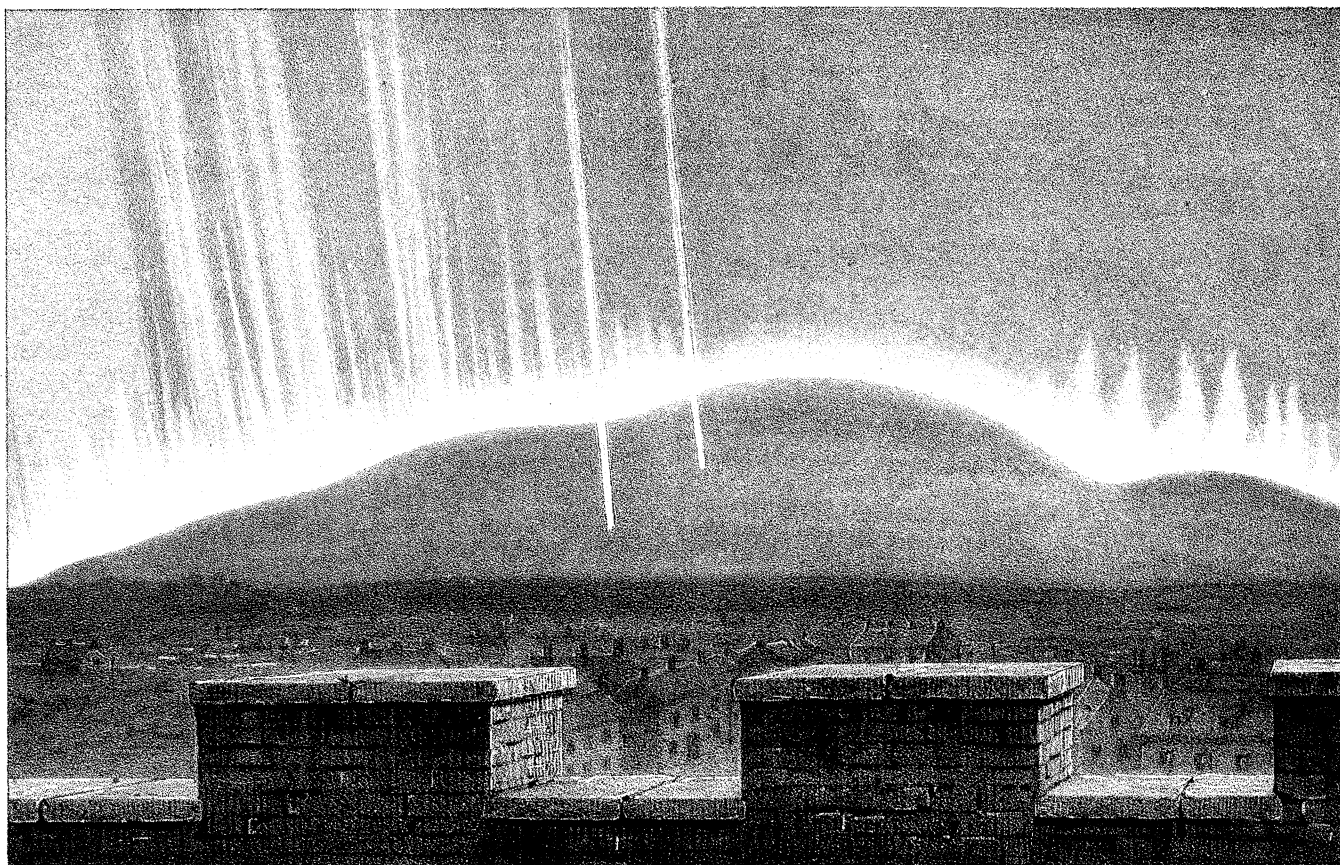
Note.—By the term *arch* is indicated the under surface of the body of light.



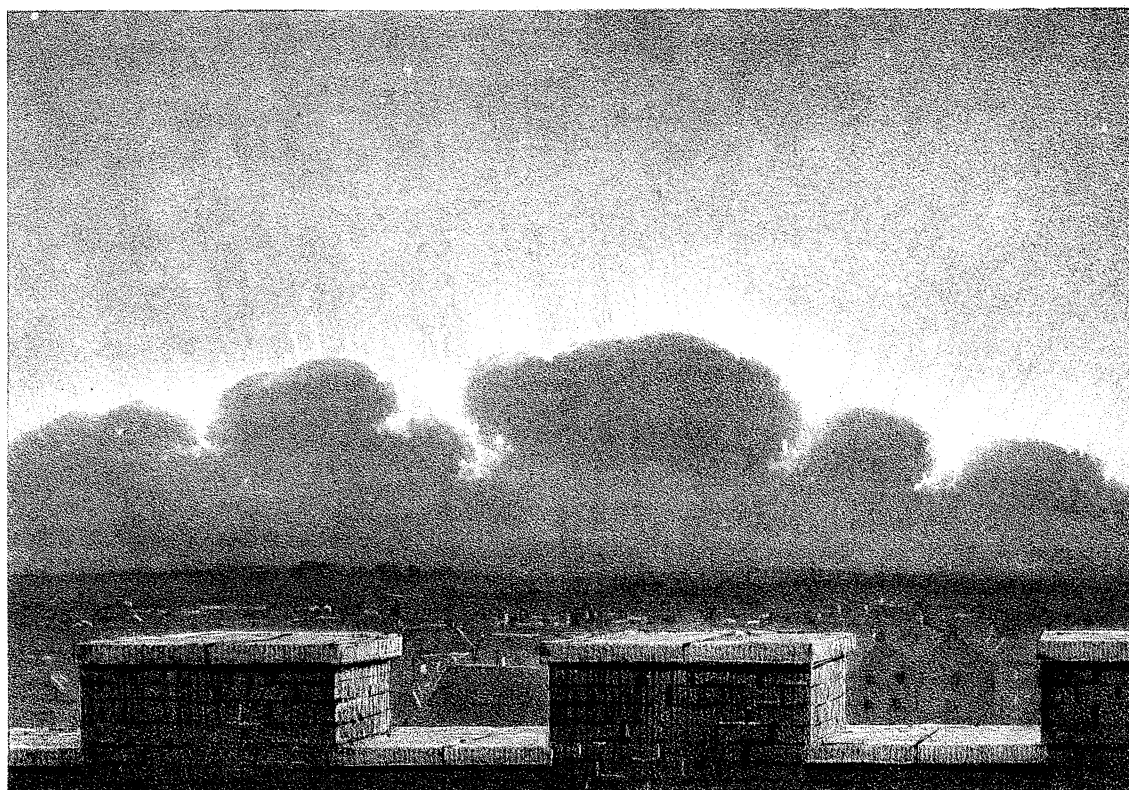
N° 1. The Aurora Borealis at 9^h 5^m.



N° 2. The Aurora Borealis at 9^h 15^m.



N^o 3. *The Aurora Borealis, at 9^h 25^m*



N^o 4. *The Aurora Borealis at 9^h 27^m*

Remarks.

Having at the time no instruments for determining the bearing or altitude of the arch, I was obliged to depend upon the positions of some conspicuous stars, which were conveniently situated for that purpose. According to these rough data, the altitude was 18° ; the angle subtended by the span of the arch about 130° ; the bearing of the centre of the arch north-north-west, true, or very nearly magnetic north; and the arch was consequently at right angles to the magnetic meridian.

The body of light was nearly colourless; its brightness was similar to that seen on the edge of a cloud when the moon is about to rise behind it, with, however, this striking difference, that the stars were distinctly seen through the diffused light of its upper surface, and those in the tail of the Bear shone clearly in the very body of the light on the right hand.

With regard to the sketches with which I have attempted to illustrate the preceding notes, it is necessary to observe, first, that the extent of horizon renders it impossible to give in one view any idea of the magnificent scale on which the original was depicted, or even to preserve very correctly the relative proportions of height and breadth; and next, that in sketches I. and II. the rapid motion of the bodies of vapoury light, and of the flame-like pencils, must be held in mind: the former bore an exact resemblance to the faint reflected light darting across the sides of a room from a mirror turned sharply in the hand, and the latter to the lambent flames which diluted spirit of wine, poured on a flat surface and ignited, will exhibit when half extinguished.

The pencils which appeared in front of the dark cloud, of which there were not more than three, were very distinct in their character from the others; they were of a yellower tinge, and extremely narrow throughout their whole height. I have stated, that they *issued from* the dark cloud; perhaps it would be more correct to say, that they *pierced through* it; for although I did not observe the instant of their appearance, being at the moment engrossed by the display on the left, yet, in each, the brightness of the base, which was, as it were, the nucleus of its light, seemed to warrant this idea. The mere circumstance, however, of their appearance in front of the cloud, tends to elucidate a point on which there exists much difference of opinion, the height of the aurora in the atmosphere. The dark cloud itself can scarcely be supposed to have occupied a very elevated region; and it is manifest, that if these brilliant pencils had their origin *in*, or *in advance of*, the cloud, their bases must have been of inferior altitude to its upper portion, and equally so, if they were identical with any continuation of the luminous matter of the arch, concealed by the cloud.

The first appearance of the aurora at nine o'clock, was that of a dark convex cloud, cutting off the luminous arch, and concealing a body of light behind, the eye naturally referring the light to a more distant region, while the sharp line of division threw the cloud forward. Subsequent appearances, however, did not seem to confirm this

notion, but, on the contrary, induced me to consider, whether the dark cloud might not be a *substratum* of matter differing in nature and density from the superincumbent arch of light. The following are the facts which appear to favour this supposition. First; every great outbreak of coruscations from the luminous arch produced a corresponding disturbance in the part of the cloud immediately below. Thus, during the display at 9^h 15^m, the arch was gradually losing its regular form on the right, and at 9^h 20^m I noted it "very irregular, with a large indentation on the eastern side," while on the west, where the body of light was undisturbed, the arch remained perfect. Thus also, immediately after the western half had been in vivid coruscation, the whole of the arch was "dilapidated," and finally, "entirely broken up." Secondly; neither the straight nor waving pencils appeared to proceed from behind the cloud, but always from the upper surface of the light. Thirdly; when the arch was "dilapidated" (see Sketch IV.), it was not merely its upper surface which was of irregular form, but masses of it were lying in confusion, separated from each other by a boundary of light, not appearing in the least as if light behind were shining through, but rather as if the substances of the arch and cloud had unwillingly interpenetrated each other, and refused to mix together more intimately, while at the same time the light above became more diffused and of diminished brightness. Lastly; when at 9^h 35^m the continuity of the arch is restored, it remains "of irregular undulating form" (fig. B.), while fainter pencils continue to rise from every part; at 9^h 55^m the cloud is "much darker," "the pencillings very faint," while its form is evidently becoming more regular (from fig. B. to fig. C.); and at 10^h 20^m it is nearly perfect in form (fig. D.), "strongly defined and steady," the pencillings having entirely ceased. All these circumstances struck me as so closely resembling the disturbance of two fluids, the one superposed on the other, mutually repulsive, but compelled to mingle by forces, of whose action the vividness of the pencillings seemed to indicate the intensity, and requiring intervals of repose to re-collect their scattered energies, that I cannot but conclude the luminous matter of an aurora to be a superincumbent stratum, and, consequently, that its altitude is dependent on that of the dark mass immediately beneath.

Bath, January 4th, 1836.